ARITERM OY

Arimatic 151

User manual

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1. General

Arimatic 151 control centre is designed to control 40-150kW bio heating systems supplied by Ariterm Oy. The centre is suitable for controlling the HakeJet, BioJet and MultiJet burners and the BioComp boiler. There are several options available for the control centre, including ash auger control , residual oxygen (Lambda sensor) and GSM alarms.

The system is controlled with programmable logic (Siemens S7-1200). The interface is a 4.3" graphic touch screen display. Arimatic 151 system burners use energy-efficient and easy to adjust EC combustion air blowers.

2. Transport, storage and package opening

The centre is delivered with a platform. The package should be opened as close to the installation site as possible. The centre should be stored indoors. It is important that the recipient check the condition of the centre before reception. In case of damage, the dealer must be contacted without delay.

It is important to inspect the contents of the centre after opening the package. Sensors included in the centre are delivered in a separate package with other equipment. Inspect the sensors by consulting the part list delivered with the package.

3. Warranty

Ariterm provides a one-year warranty for its equipment. The warranty is valid for one year starting from the date of implementation or for maximum of 18 months from the date of delivery.

The warranty covers craftsmanship and material defects. Ariterm Oy will deliver new replacement parts for defective parts free of charge.

Spare parts are provided with a 12-month warranty.

The warranty does not cover damages resulting from incorrect installation or thunder.

4. Installation and commissioning

Install the centre in a place where the system is easy to use and cables are easy to install. The centre should have 1 m of space in front of it.

Electrical connections should be done according to the wiring diagrams. The wiring diagrams also indicate accessories. If no safety devices are connected to the system, the respective terminal block should be short-circuited. Example: Dry-boiling protection is not required for systems under 100kW. If there is no dry-boiling protection, a permanent loop should be installed between terminal blocks 10X1: 24 V DC and 41.

Current limits for the thermal overload relays and motor protectors should be set according to the current value consumed by the motor. The current values are indicated in the type plate of the motor.

The centre can be started once all electrical connections are completed. By accessing the *OPTIONS* -menu from the ***SETTINGS*** -page, you can configure system devices, such as Ash screw 1. Do not select functions/devices not included in the system, because they may cause unnecessary alarms. NOTE! The *OPTIONS* -menu can be accessed with Maintenance -level codes.

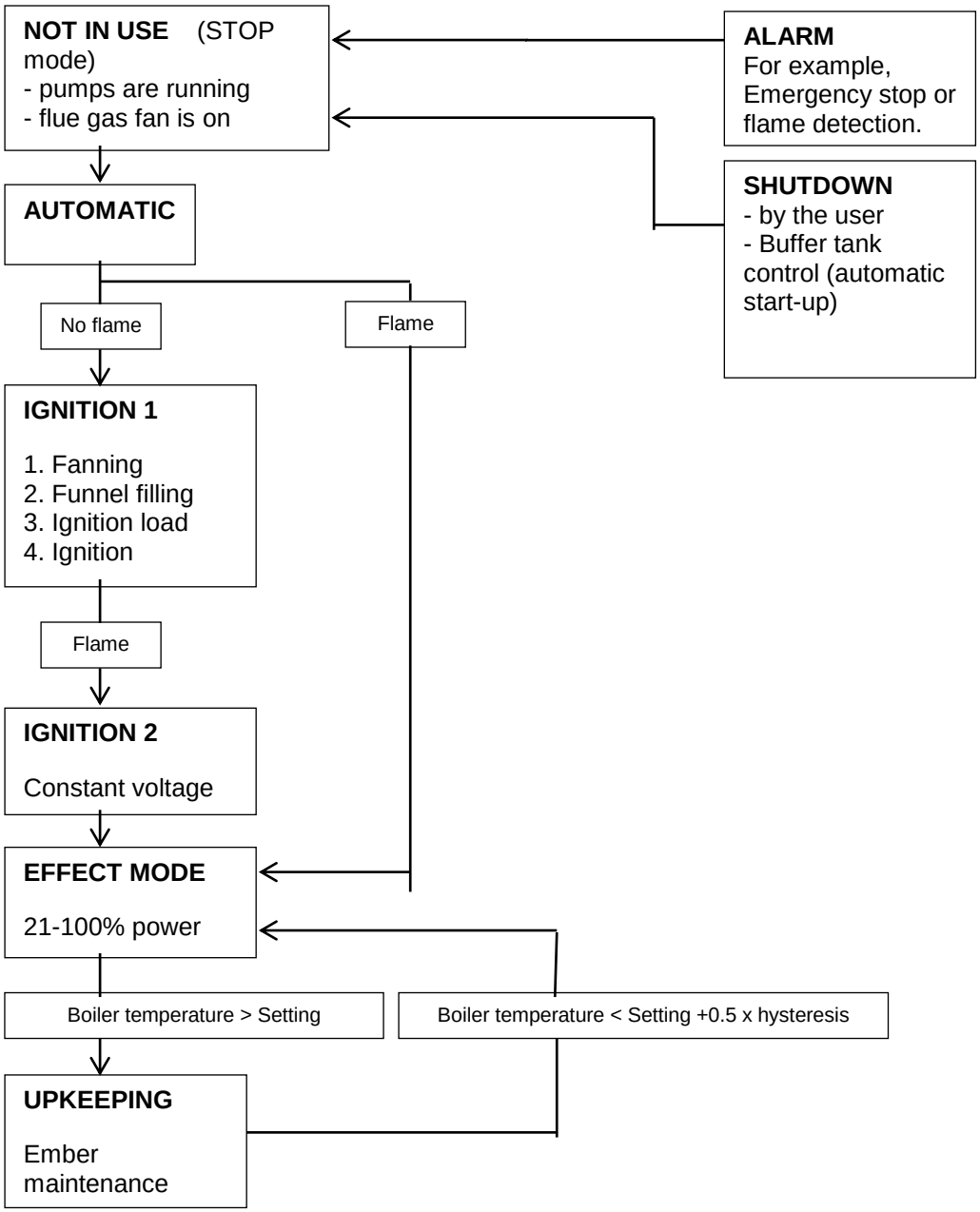
After completing system configuration, check the system for any alarms caused by, for example, uninstalled or incorrectly connected sensors. Functionality of all safety devices, such as emergency stop buttons, thermostats and hatch switches must be tested/checked.

Then, check the rotation directions of screws and test all functions (fans, screws/augers) in the *MANUAL* -menu.

The system has factory default settings, but certain settings, such as the *EFFECT* -settings should be adjusted according to the fuel (Check chapter 14). Adjustments should be made by means of a flue gas analyser in order to ensure clean combustion. Additionally the *STORAGE AUGER* -settings must be adjusted based on the size of the funnel between the feeding auger and the storage auger.

NOTE! If the system is equipped with automatic ignition, the *AUTOMATIC IGNITION* -settings must always be defined case-specifically. The settings should be made by an authorised maintenance professional during commissioning. Incorrect ignition times and settings may result in a failed ignition and halt the system.

5. System description



The system is started with the AUTOMATIC -button, after which the ignition pages open. If the flame detection system detects a flame in the burner head, the burner switches to effect mode. After the ignition phase, the burner switches to effect mode, during which the effect of the burner is adjusted according to the required heating power. The automatic system attempts to maintain the boiler water temperature at the set level. If a high level of heating is not required, but the boiler water temperature increases excessively, the burner will activate the upkeeping mode.

The burner uses the upkeeping mode to maintain ember in the burner head. When the boiler water temperature decreases, the burner returns to the effect mode. The user can stop storage operation and empty the burner screw by

pressing the SHUTDOWN -button. This function is used, for example during maintenance.

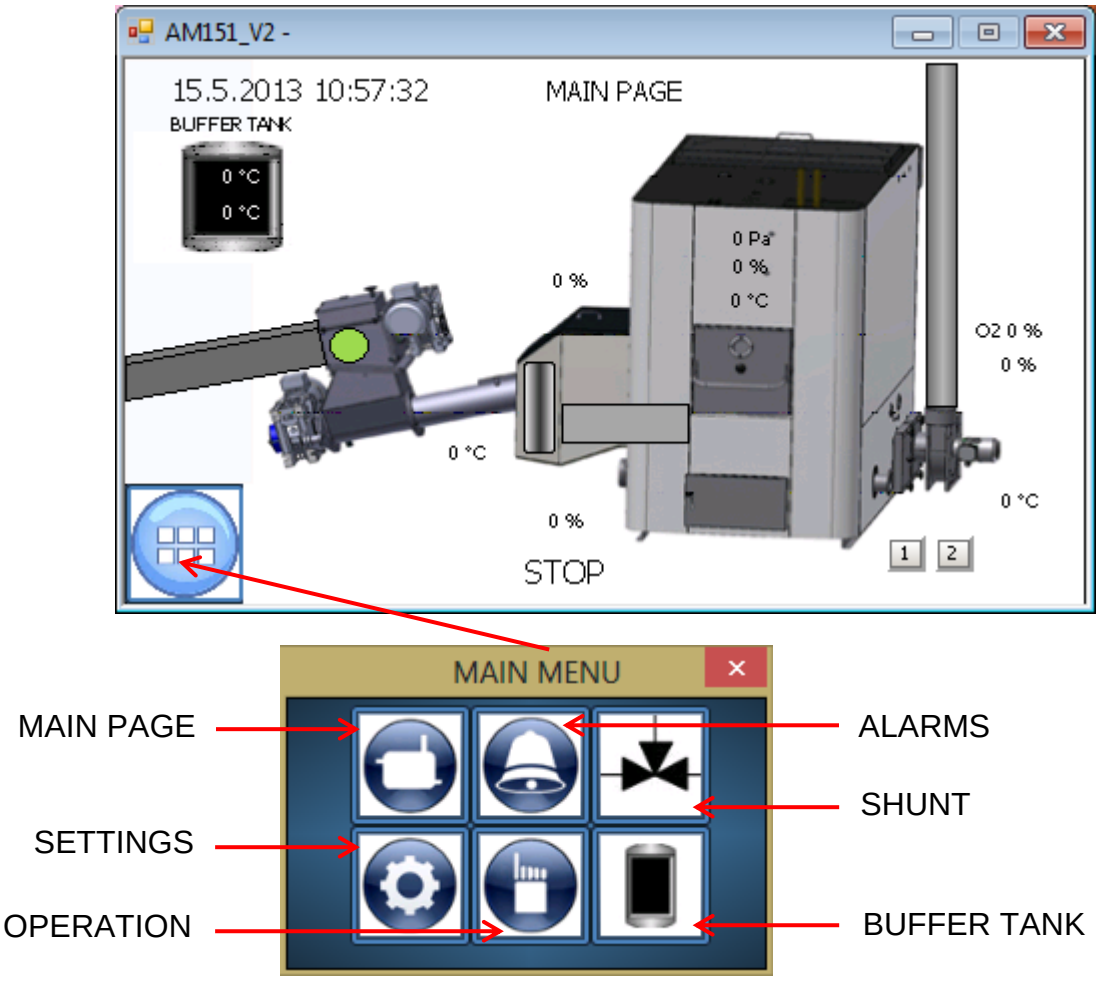
STOP -button stops the system immediately. Only the pumps and the smoke gas fan remain in operation. These operations must be stopped manually.

In buffer tank use, the shutdown function is activated automatically, when the lower temperature of the buffer tank exceeds its setting (e.g. 80°C). Automatic ignition starts when the buffer tank temperature decreases below its setting (e.g. 60°C).

Alarms are indicated with a red blinking light appearing on the display. The ***ALARMS*** -page indicates the reason for the alarm and its time. You can acknowledge alarms and review the alarm history.

6. Operating the system

The graphic interface makes it easy to control the system. The interface contains four main pages: ***MAINPAGE, ALARMS, SETTINGS*** and ***OPERATION***. You can navigate the pages with the button located on the bottom of the display.



The ***MAINPAGE*** displays the operation of the system. The page contains, for example, temperature, blower power and the operation of the feeding auger.

The ***ALARMS*** -page displays active error notifications. You can also acknowledge alarms and review the alarm history here.

The ***SETTINGS*** -page contains the settings menus where you can adjust the parameters of various functions. The menus displayed are determined according to the features activated in the *OPTIONS* -menu.

The system is operated from the ***OPERATION*** -page. The user can perform operations manually, set the system run them automatically or stop the system. The page also includes, for example, pump operations.

The system has two password-protected user levels: USER and MAINTENANCE. The USER levels restrict access to all settings, preventing unauthorised users from adjusting the settings. The USER level user name is **user** and the password is **user**.

The MAINTENANCE level is for authorised maintenance professionals, restricting access to, for example, sensor scaling settings, PID parameters and *OPTIONS*-menu.

7. Main pages

7.1 *MAIN PAGE*

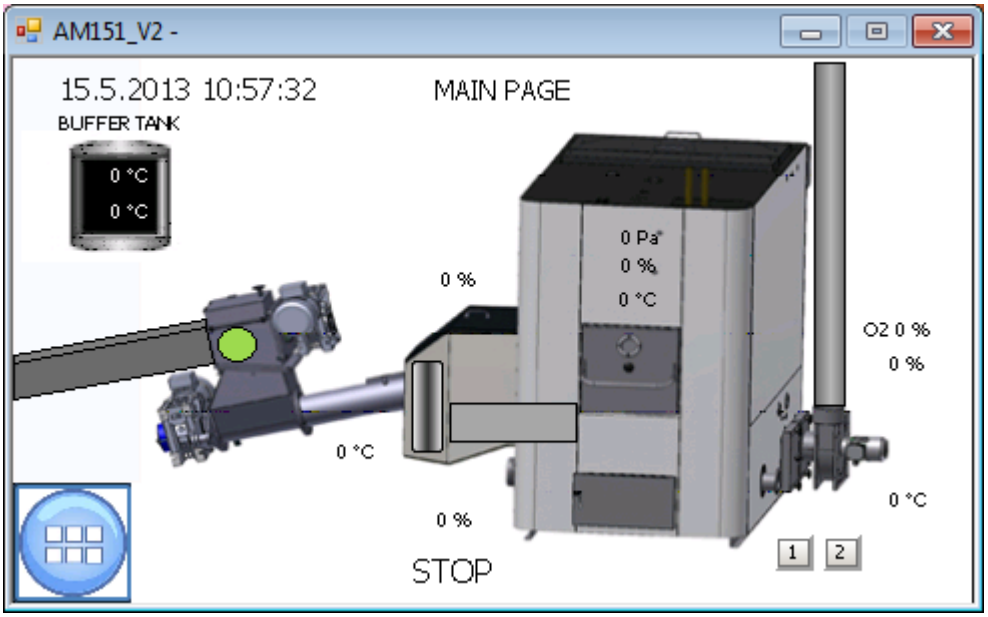


Figure 1. MAIN PAGE - burner in STOP mode.

The interface ***MAINPAGE*** contains the following items:

- Burner mode (EFFECT MODE,UPKEEP, MANUAL, STOP)
- Boiler water temperature
- Effect percentage at which the burner is currently run
- Primary and secondary fan power
- Smoke gas fan power
- Operation of burner screw
- Operation of storage auger
- Funnel surface level sensor status
- Flame detection information
- Underpressure of combustion chambers
- Residual oxygen (if option is activated)
- Burner screw temperature (if option is activated)
- Bar discharger (if option is activated)
- Silo lower limit (if option is activated)
- Time and date.

System settings cannot be adjusted on the ***MAINPAGE***. Settings can be adjusted on the ***OPERATION*** -page.

7.2 *ALARMS* -page

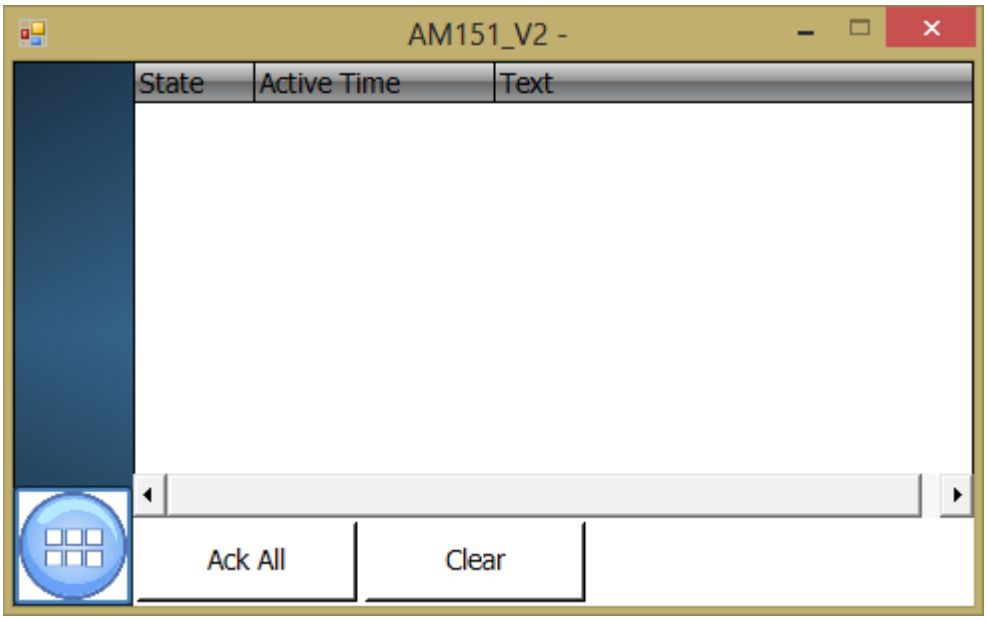


Figure 2. ALARMS -page

Alarms are indicated with a red blinking light appearing on the display and the system goes into **Stop**-mode. The ***ALARMS*** page displays active alarms

(State), time (Active Time) and the reason for the alarm (Text). The source of the alarm must be removed before the alarm can be acknowledged (Ack All button). The alarms are recorded in the alarm history, which can be reset with the Clear button.

The system must be restarted with the AUTOMATIC -button after acknowledging alarms.

7.3 *SETTINGS* -page

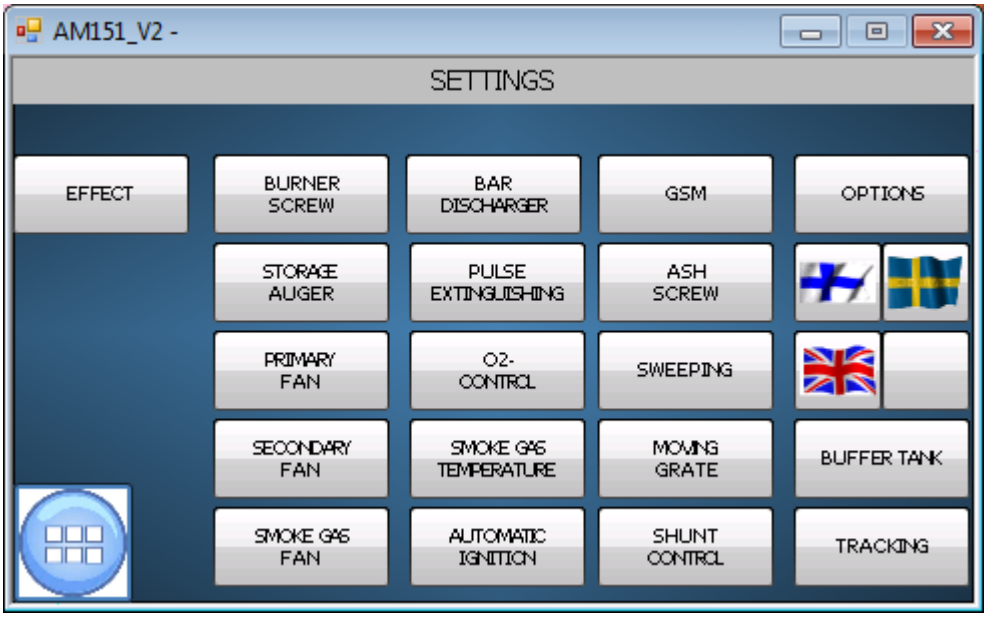


Figure 3. SETTINGS page - all options selected.

The ***SETTINGS*** -page contains the settings menus where you can adjust the parameters/settings of various functions. The menus displayed are determined according to the features activated in the *OPTIONS* -menu.

The following menus are always displayed: *EFFECT,BURNER SCREW, STORAGE AUGER, PRIMARY FAN, SECONDARY FAN, SMOKE GAS FAN, LANGUAGE* and *OPTIONS.*

7.4 *OPERATION* -page

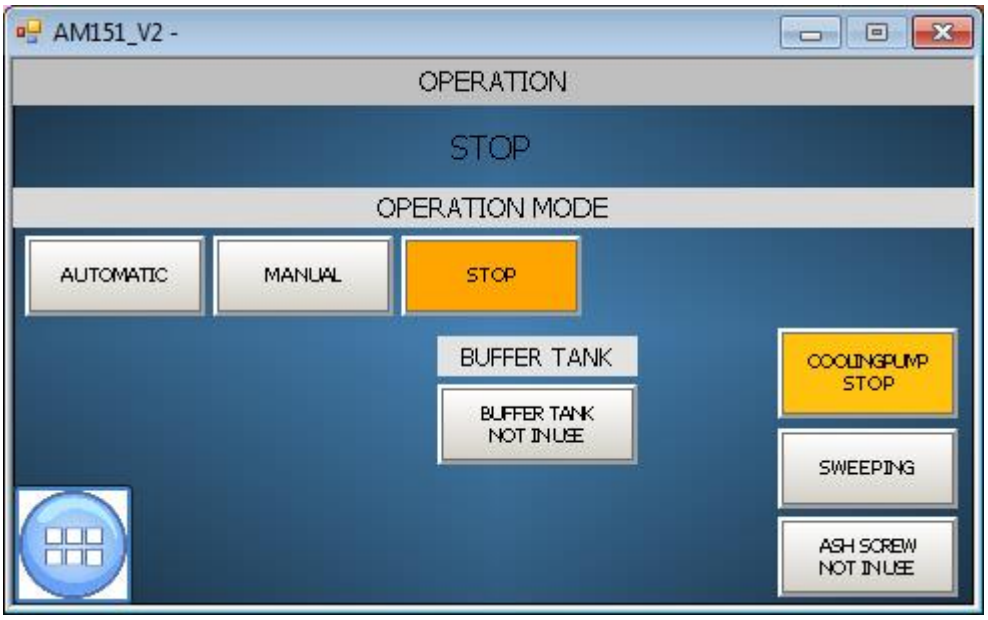


Figure 4. OPERATION page - System in STOP mode.

The system is operated from the ***OPERATION*** -page. When the system is stopped (STOP), the AUTOMATIC, MANUAL and STOP buttons are displayed. The upper field indicates system status "STOP". When the system is in the **Automatic** mode (burner in effect mode), the SWEEPING and SHUTDOWN -buttons appear instead of the MANUAL -button.

If the Sweeping and Ash screw options are selected, their operating buttons are displayed. These buttons can be used to override their scheduled operation.

The system is stopped with the STOP -button. However, the cooling pump and the smoke gas fan must be stopped with their dedicated buttons.

MANUAL MODE

It is necessary to run the system manually during commissioning or, for example, maintenance. If the user opens the manual operation page during automatic operation (NOTE! STOP -button must be pressed first), the smoke fan and pumps remain in operation. The following functions are controlled here:

- Burner screw
- Storage auger
- Primary fan power adjustment
- Secondary fan power adjustment
- Smoke gas fan power adjustment
- Bar discharger system
- Ash screws
- Moving grate
- BACKWARD -button for reversing the screws/augers.
- Sweeping
- Cooling pump
- Hot air gun

NOTE! The buttons displayed on the *MANUAL* -page depend on settings made (selected functions) on the *OPTIONS* -page.

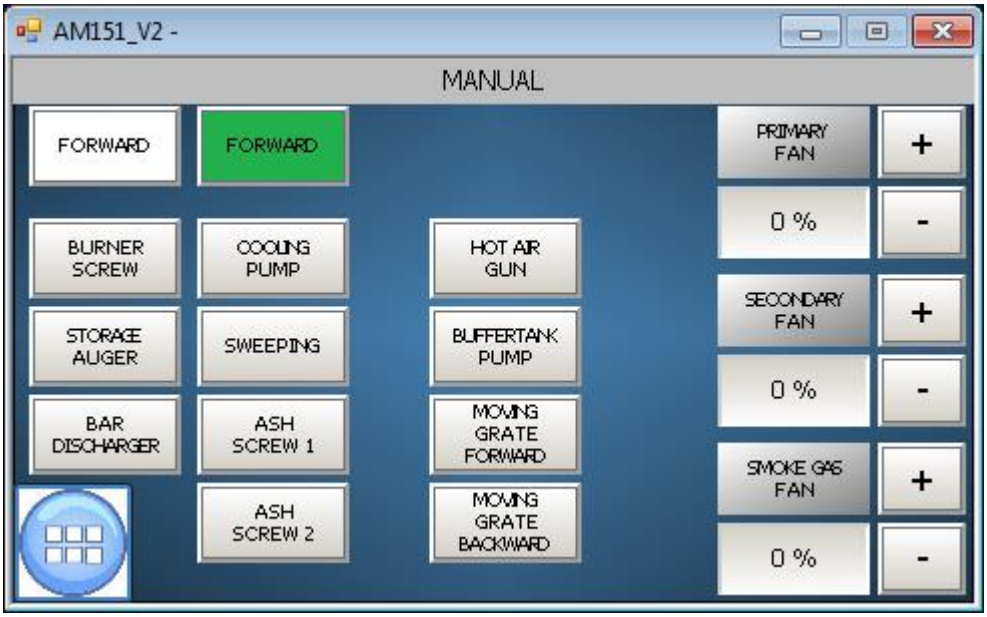


Figure 5. Manual -page

AUTOMATIC

If the burner is set to **Automatic** mode, the burner will activate the **Effect** - mode, when the flame detection system detects a flame. Burner effect is adjusted on a scale of 20-100%. If the flame detection does not detect a flame, the system activates the controlled ignition phase (see section 11. Ignition)

SHUTDOWN

This function stops the storage system operation and the funnel is no longer filled. The system continues to operate as long as the burner screw and funnel contain fuel. The operation stops, when the **Alarm! Flame** alarm is displayed. The function can be used, for example, during preparations for boiler and burner maintenance.

In buffer tank use, the shutdown function is activated automatically, when the lower temperature of the buffer tank exceeds its setting. The burner will remain in standby mode. The start-up command is given when the buffer tank upper temperature falls below the set temperature.

STOP

This button stops all devices of the system, except for the cooling pump and the smoke gas fan which must be stopped with their dedicated buttons.

SWEEPING

This button controls the convection sweeping motor, overriding their scheduled functions.

ASH SCREW

This button controls the ash screws, overriding their scheduled functions.

8. Options

All features/accessories of the system are configured in the *OPTIONS* -menu during commissioning. Example: The woodchip system consists of the hydraulic storage T1, MultiJet 60kW burner, pulse extinguishing system and residual oxygen measurement. When using the system, the bar discharger, moving grate, pulse extinguishing system and O2-control must be enabled in the *OPTIONS* -menu. Then, the settings menus of the functions appear on the ***SETTINGS*** -page.

NOTE! Make sure that unconnected options are not enabled. Otherwise they may cause unnecessary alarms.

Available options:

1. Burner screw temperature
2. Pulse extinguishing
3. Burners cooling pump (BioJet)
4. Shunt control (Heating circuit control)
5. Bar discharger
6. Ash screw 1
7. O2-control
8. Smoke gas temperature
9. Sweeping
10. Ash screw 2
11. Moving grate (MultiJet)
12. Automatic ignition
13. Buffer tank
14. GSM (SMS alarms)

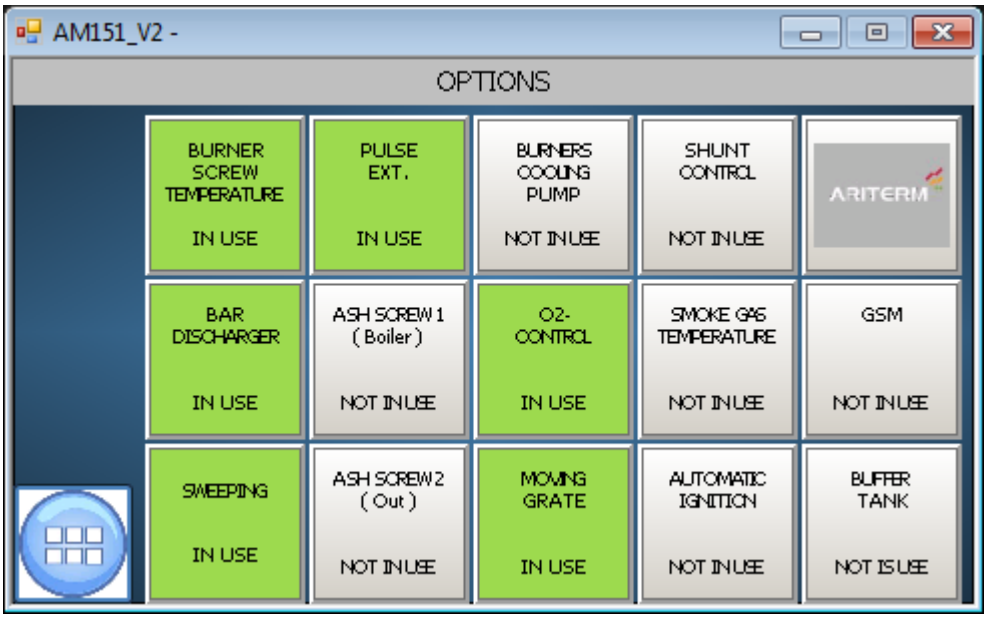


Figure 6. OPTIONS -page

9. Time and date

Settings are displayed on the top left corner of the ***MAIN PAGE***. You can adjust time and date by pressing the respective button.

10. Language

You can select the OSD language by pressing a flag on the ***SETTINS*** -page.

11. Ignition

If the AUTOMATIC -button is pressed on the ***OPERATION*** -page, the smoke gas fan ventilates the boiler (2 min). If the flame detection does not detect a flame, the user can select the **Automatic** or **Manual** ignition (NOTE! automatic ignition is an accessory).

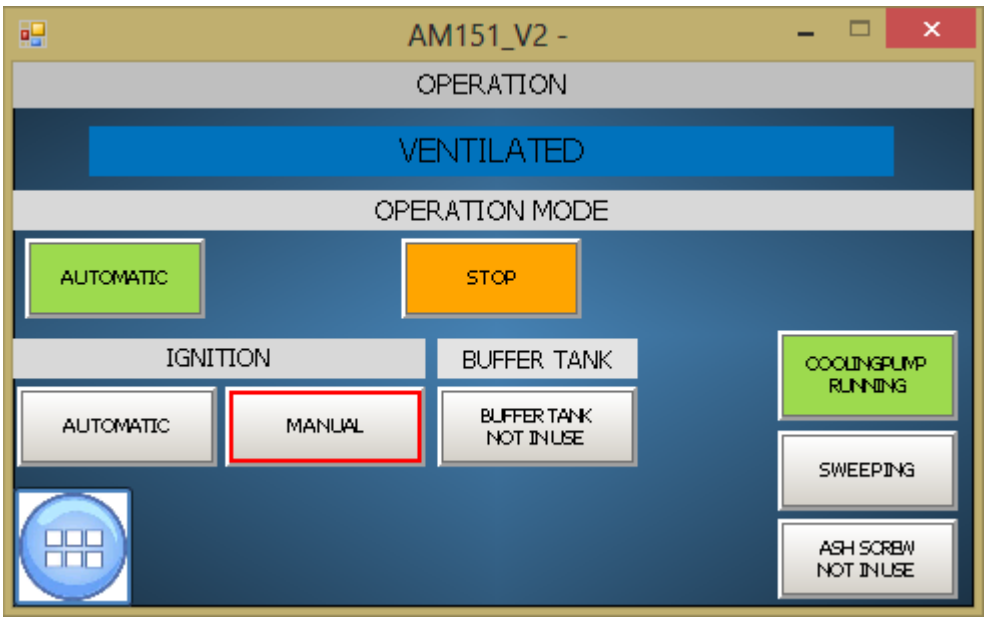


Figure 7. Ignition selection

MANUAL IGNITION

With the manual ignition, the user can manually run the burner screw or switch on the primary or secondary fan.

If the automatic ignition option is enabled, the HOT AIR GUN -button will also be displayed. The ignition can also be used for manual ignition.

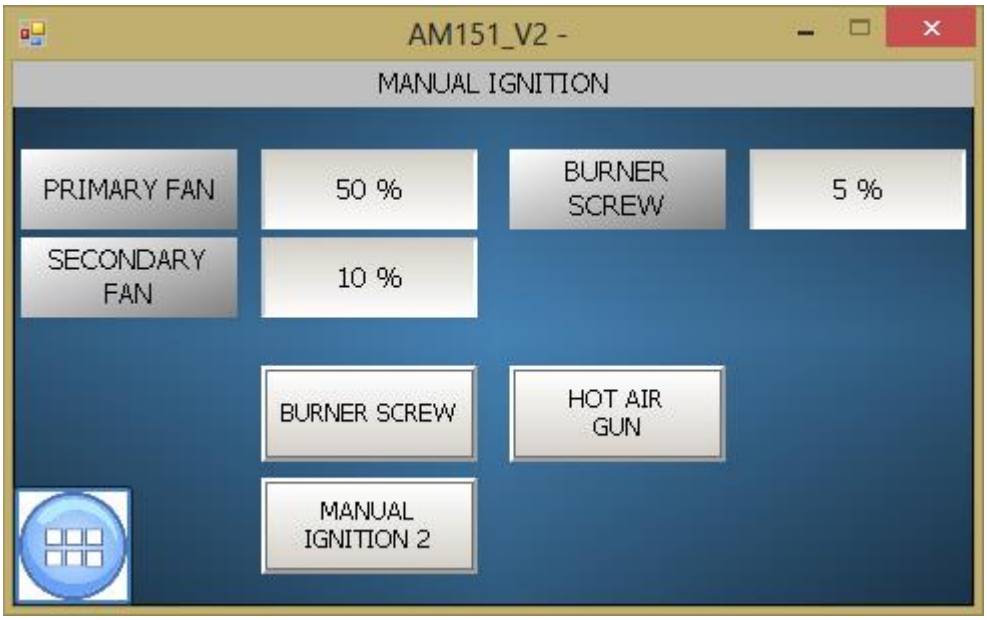


Figure 8. Manual ignition -page - Burner equipped with automatic ignition.

Run the burner auger with the BURNER SCREW -button so that the burner head has enough fuel. The storage auger automatically fills the funnel while the smoke gas fan maintains an underpressure in the combustion chamber. Ignite the fuel and turn on combustion air fans. Wait for the fuel to properly ignite. You can add more fuel to the burner head. When the flame is large enough, the **Ignition 1** -phase can be acknowledged with the MANUAL IGNITION 2 -button, after which the system will proceed to the **Ignition 2** -phase.

During the **Ignition 2** -phase, the burner is run at a fixed effect level, which the user can adjust. In this case, the fuel feed and fanning is controlled automatically. **NOTE! During the first heating process, the burner should be run at low power (21-30%) for approximately one hour in order to remove humidity from the burner ceramics.** When the flame detection detects a flame, a flame symbol will be displayed . Then you can activate automatic effect adjustment by pressing the MAN. IGNITION READY -button. You do not need to wait for the flame information. The **Ignition 2** can be acknowledged earlier as well.

The flame information is provided by the flame detection thermostat measuring the temperature of smoke gas. When the smoke gas temperature exceeds the thermostat limit (approximately 70°C), the flame information is displayed. The flame detection phase (10 min.) is activated after the **Ignition 2** -phase. During this phase, the smoke gas temperature increases over the set temperature.

If the system is equipped with automatic ignition, the flame data is monitored during the ignition with an optical flame detection sensor.

11.1 Automatic ignition

If automatic ignition is enabled in the *OPTIONS* -menu, the *AUTOMATIC IGNITION* -menu is displayed on the **SETTINGS** -page. NOTE! Only authorised service professionals can adjust the automatic ignition settings.

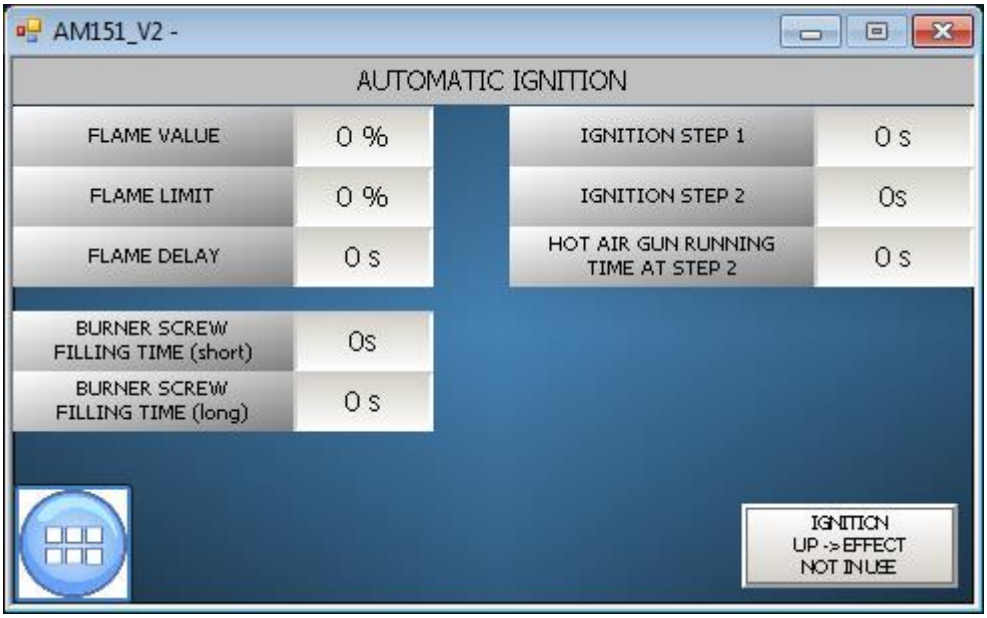


Figure 9. AUTOMATIC IGNITION -settings

Setting	Factory setting	Setting frequency	Function
Flame value	True value	0-100%	Displays the true reading of the optical flame detection.
Flame limit	5%	0-100%	Flame detection limit value for the optical flame detection sensor.
Flame delay	30s	0-360s	Delay during which the flame detection should detect the flame.
Ignition step 1	240s	0-600s	Length of the Ignition 1 -phase, during which the flame should be recognised. Hot air gun and combustion air fans are on.
Ignition step 2	600s	0-1200s	Length of the Ignition 2 -phase, during which the burner runs at a set power level before switching to automatic adjustment.
Burner screw filling time (short)	20s	0-360s	If the burner screw is full in the beginning of ignition, the automatic ignition can also be initialised with a short ignition.
Burner screw filling time (long)	20s	0-600s	The burner screw should be empty in the beginning of automatic ignition.

			Then, the burner screw feeds fuel to the burner head for the duration of the set time. There should be an appropriate amount of fuel in the burner head.
Hot air gun running time at step 2	30s	0-360s	Hot air gun operation time after flame detection (ignition phase 2).

The automatic ignition is initialised either by the user or automatically by the accumulator upper temperature sensor. The storage auger automatically fills the funnel and the boiler is ventilated before ignition. When the funnel is full, the burne screw runs for the duration of the **Burner screw filling time (long)** -setting, feeding an appropriate amount of fuel to the burner head. NOTE! If the system is halted by an alarm while the burner screw is full of fuel, the user can select a short filling time during ignition. During the short filling, the screw will feed the burner head for the duration of the **Burner screw filling time (short)** -setting.

The hot air gun and combustion air fans operate for the duration of the **Ignition step 1** -setting. If the flame detection detects a flame, the burner will activate the **Ignition 2** -phase. The optical flame detection sensor must detect a flame during the duration of the **Flame delay** -setting in order to activate the flame data. If the flame detection fails to detect a flame during the **Ignition step 1** -time setting, the fans and ignition stop and the **Alarm! automatic ignition** alarm is displayed.

During the **Ignition 2** -phase, the burner runs at a power level configured in the **Burner screw** -setting for the duration of the **Ignition step 2** -setting. After this the burner automatically activates the effect mode. If the flame disappears during the **Ignition 2** -phase, the **Alarm! Automatic ignition** -alarm is displayed.

Power settings for the burner screw and the combustion air fans during the ignition phases are set in the *BURNER SCREW/PRIMARY FAN/SECONDARY FAN* -setting pages.

The hot air gun can be activated by pressing the IGNITION UP->EFFECT -button once the burner switches from **Upkeep** to **Effect** mode.

12. Effect

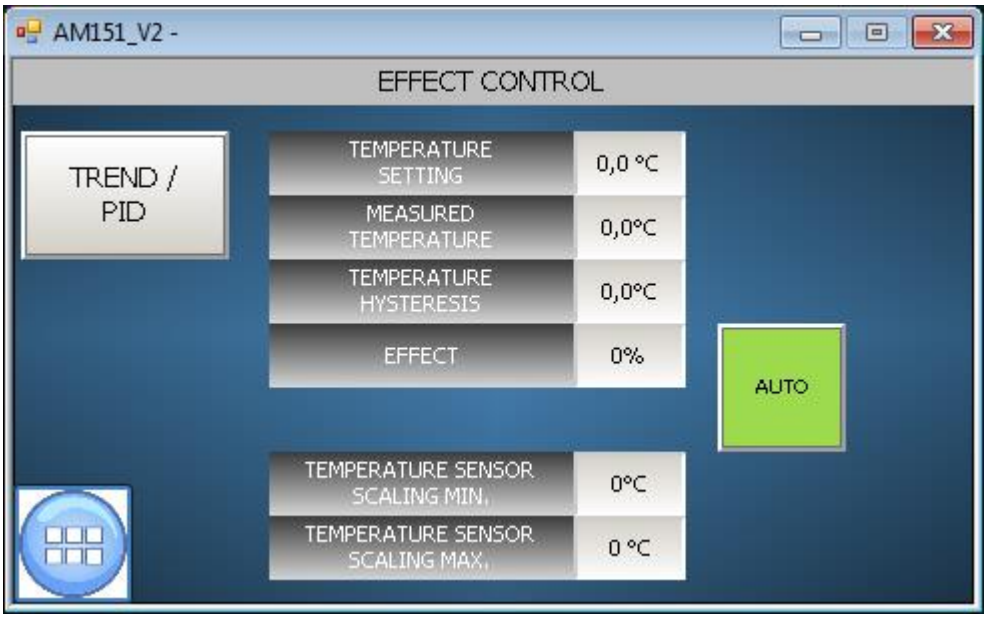


Figure 10. EFFECT -settings

Setting	Factory setting	Setting frequency	Function
Temperature setting	80°C	0-100°C	Set boiler water temperature. The burner maintains the set temperature.
Measured temperature	True value	-10…150°C	True boiler water temperature.
Temperature hysteresis	5°C	0-50°C	If the boiler water temperature increases above the set boiler water temperature by the amount of the hysteresis, the burner activates the maintenance mode. When the boiler water temperature decreases by 0.5 x hysteresis, the burner switches back to power mode (E.g. at 82.5°C)
Effect	True value	0-100%	True burner power
Manual effect setting	21%	20-100%	Burner power in manual operation mode. The burner will run at a constant power, until the boiler water temperature increases over the set temperature by the amount of hysteresis.
Temperature sensor scaling min	-10	-150...150°C	Boiler water temperature scaling. NOTE! Requires Maintenance level password.
Temperature sensor scaling max	150	-150…150°C	Boiler water temperature scaling. NOTE! Requires Maintenance level password.

Burner power is adjusted according to the boiler water temperature. The desired boiler water temperature is entered into the **Temperature setting** -field. Burner effect PI control maintains the set temperature. The **Temperature hysteresis** -setting determines the temperature at which the burner switches to **upkeep** mode.

EXAMPLE: if **Temperature setting** = 80°C and **Temperature hysteresis** = 5°C, the burner switches to **upkeep** mode when the boiler water temperature reaches 85°C. When the temperature decreases by 0.5 x **Hysteresis**, 2.5°C in the example, the burner switches back to **effect** mode (effect level 21%).

During normal use the burner is run by automatically adjusting the effect according to temperature requirements. In this case, the effect is adjusted in 1% increments between 20-100%. The burner can also be run at a fixed effect during burner adjustments. The desired effect percentage is set with the **Manual effect setting** after the AUTO/MANUAL -button is pressed to select the MAN -mode. In this mode, the burner is run at a fixed effect, until hysteresis switches the burner to **upkeep** mode. Upon switching back to effect mode, the burner continues at a fixed effect level.

By pressing the TREND/PID -button, you can review effect and boiler water temperature changes in a time range. The trend review tool is particularly useful for adjusting effect parameters during commissioning. This also allows the user to adjust the enhancement and Ti values of the control. The **Gain (P)** and **Integration time** (**Ti)** -settings control the adjustment speed and accuracy.

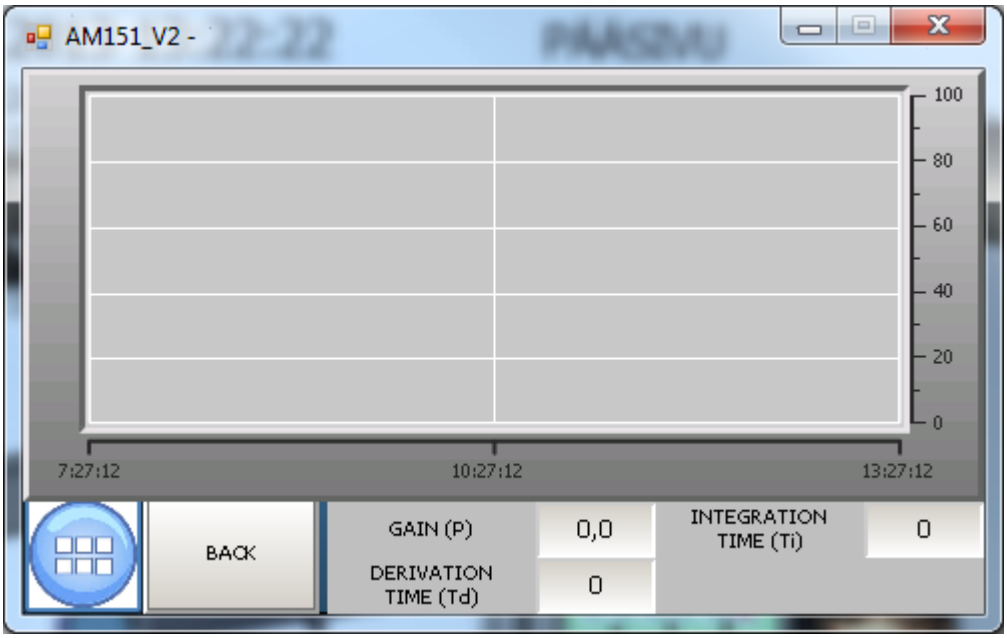


Figure 11. EFFECT CONTROL page - Trend.

13. Effect settings

The control system adjusts the burner effect by controlling the fuel feed (burner screw pulse and pause time ratio) and the rotation speed of the primary and secondary fans according to heat load changes.

The programme has 80 effect levels (**upkeep** mode 20%, **effect** mode 21-100%). The ***SETTINGS*** -page contains the BURNER SCREW*, PRIMARY FAN and SECONDARY FAN* -menus for setting the speed of the burner screw and the rotation speed of the primary and secondary fan (0-100%) in five power levels: UP, 21%, 50%, 75% and 100%. The programme calculates intermediate power levels according to these basic settings (e.g. 22, 23, 24…%).

13.1 Burnerscrew settings

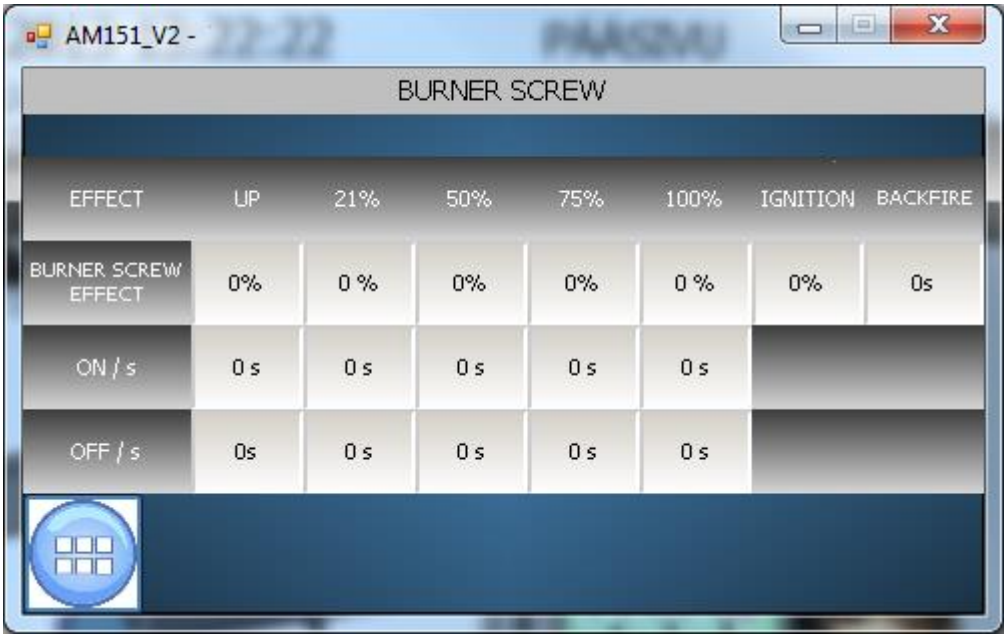


Figure 12. BURNER SCREW settings.

Effect point	Factory setting	Setting frequency	Function
UP	0.5%	0-100%	Burner screw power in upkeep mode.
21%	2.0%	0-100%	Burner screw power at 21%.
50%	5.0%	0-100%	Burner screw power at 50%.
75%	8.0%	0-100%	Burner screw power at 75%.
100%	10.0%	0-100%	Burner screw power at 100%.
Ignition	5%	0-100%	Burner screw power during Ignition 2 phase.
Backfire	240s	0-600s	Burner screw operating time when back fire thermostat is set off. The Burner screw should be emptied during this time. The storage stops.

The Burner screw power is indicated in percentages. The system calculates the running and pause times automatically according to the effect percentage. For example, "Power-% = 10%" indicates a running time of 1s and pause time of 9s. The system calculates the intermediary power percentage automatically. See factory settings in section 12.4.

You must enter the **user** password in order to adjust the *BURNER SCREW* -settings.

13.2 Primary fan settings

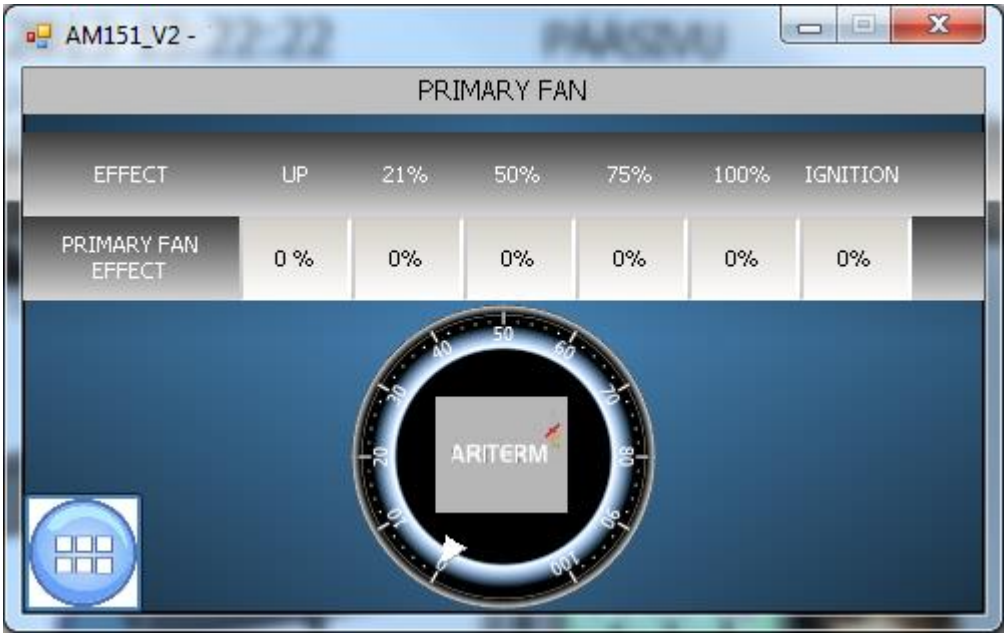


Figure 13. PRIMARY FAN -settings

Power point	Factory setting	Setting frequency	Function
UP	0.0%	0-100%	Primary fan power in upkeep mode.
21%	25%	0-100%	Primary fan power at 21%.
50%	35%	0-100%	Primary fan power at 50%.
75%	50%	0-100%	Primary fan power at 75%.
100%	70%	0-100%	Primary fan power at 100%.
Ignition	20%	0-100%	Primary fan power during Ignition 2 phase.

The primary fan power is determined between 0-100% for each effect point of the chart. The system calculates the intermediary power percentage automatically. The primary fan fans combustion air from underneath the fuel, gassing the fuel. See factory settings in section 12.4.

You must enter the **user** password in order to adjust the *PRIMARY FAN* -settings.

13.3 Secondary fan settings

Figure 14. SECONDARY FAN -settings

Power point	Factory setting	Setting frequency	Function
UP	0.0%	0-100%	Secondary fan power in upkeep mode.
21%	15%	0-100%	Secondary fan power at 21%.
50%	30%	0-100%	Secondary fan power at 50%.
75%	45%	0-100%	Secondary fan power at 75%.
100%	65%	0-100%	Secondary fan power at 100%.
Ignition	10%	0-100%	Secondary fan power during Ignition 2 phase.

The primary fan power is determined between 0-100% for each effect point of the chart. The system calculates the intermediary power percentage automatically. The secondary fan fans combustion air from above the fuel, burning the gassed fuel. See factory settings in section 12.4.

You must enter the **user** password in order to adjust the *SECONDARY FAN* -settings.

14. Factory settings

Consult the following charts for making adjustments. Combustion air fan power adjustments should be made by means of a flue gas analyser in order to ensure clean, efficient combustion. According to user experiences, the maintenance mode settings in particular require certain initial adjustments.

14.1 Pellet auger

Burner screw diameter 114mm, bore diameter 95mm, auger elevation angle 20°, rotation speed 19rpm. Auger production 291.6kg/h, corresponding to 1260kW (pellet energy 4.8kWh/kg, boiler efficiency 90%).

40kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	6kW	0.5	0%	0%
21%	9kW	0.7	20%	15%
50%	20kW	1.6	30%	25%
75%	30kW	2.4	40%	40%
100%	40kW	3.2	50%	55%

60kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	6kW	0.5	0%	0%
21%	12kW	0.9	25%	15%
50%	30kW	2.4	40%	35%
75%	45kW	3.6	55%	45%
100%	60kW	4.8	60%	65%

80kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	8kW	0.6	0%	0%
21%	17kW	1.3	30%	20%
50%	40kW	3.2	50%	45%
75%	60kW	4.8	60%	60%
100%	80kW	6.3	65%	65%

120kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	12kW	0.9	0%	0%
21%	25kW	2.0	35%	20%
50%	60kW	4.8	50%	45%
75%	90kW	7.1	65%	60%
100%	120kW	9.5	70%	55%

150kW system				
Effect	**Power kW**	**Burner screw**	**Primary blower**	**Secondary blower**
Upkeep	15kW	1.2	0%	0%
21%	30kW	2.4	35%	20%
50%	75kW	6.0	50%	45%
75%	110kW	8.7	65%	60%
100%	150kW	12.0	80%	75%

14.2 Pellet feeder PS10 (250-400kW)

Pellet feeder production (250kW-400kW) is approximately 250kW at 50Hz (efficiency 90%).

40kW system, PS10 250-400kW				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	6kW	2.5	0%	0%
21%	9kW	3.7	20%	15%
50%	20kW	8.2	30%	25%
75%	30kW	12.3	40%	40%
100%	40kW	16.5	50%	55%

60kW system, PS10 250-400kW				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	6kW	2.5	0%	0%
21%	12kW	5.0	25%	15%
50%	30kW	12.3	40%	35%
75%	45kW	18.5	55%	45%
100%	60kW	33.0	60%	65%

80kW system, PS10 250-400kW				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	8kW	3.3	0%	0%
21%	17kW	7.0	30%	20%
50%	40kW	16.5	50%	45%
75%	60kW	24.7	60%	60%
100%	80kW	33.0	65%	65%

120kW system, PS10 250-400kW				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	12kW	4.9	0%	0%
21%	25kW	10.3	35%	20%
50%	60kW	24.7	50%	45%
75%	90kW	37.1	65%	60%
100%	120kW	49.5	70%	55%

150kW system, PS10 250-400kW				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep	15kW	6.2	0%	0%
21%	30kW	12.3	35%	20%
50%	75kW	30.9	50%	45%
75%	110kW	45.3	65%	60%
100%	150kW	61.8	80%	75%

14.3 Wood chip auger

Burner screw diameter 159mm, bore diameter 135mm, auger elevation angle 20° rotation speed 11.5rpm. Auger production 0.486m3/h, corresponding to 317kW (chip 750kWh/m3, boiler efficiency 87%).

40kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep		0.5	0%	0%
21%	9kW	2.8	20%	15%
50%	20kW	6.3	30%	25%
75%	30kW	9.5	40%	40%
100%	40kW	12.6	50%	55%

60kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep		0.5	0%	0%
21%	12kW	3.7	25%	15%
50%	30kW	9.4	40%	35%
75%	45kW	14.1	55%	45%
100%	60kW	19.0	60%	65%

80kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep		0.5	0%	0%
21%	17kW	5.4	30%	20%
50%	40kW	12.6	50%	45%
75%	60kW	19.0	60%	60%
100%	80kW	25.2	65%	65%

120kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep		0.5	0%	0%
21%	25kW	7.9	35%	20%
50%	60kW	19.0	50%	45%
75%	90kW	28.3	65%	60%
100%	120kW	37.8	70%	55%

150kW system				
Effect	**Power kW**	**Burner screw**	**Primary fan**	**Secondary fan**
Upkeep		0.5	0%	0%
21%	30kW	9.4	35%	20%
50%	75kW	23.6	50%	45%
75%	110kW	34.7	65%	60%
100%	150kW	47.3	80%	75%

15. Storage auger settings

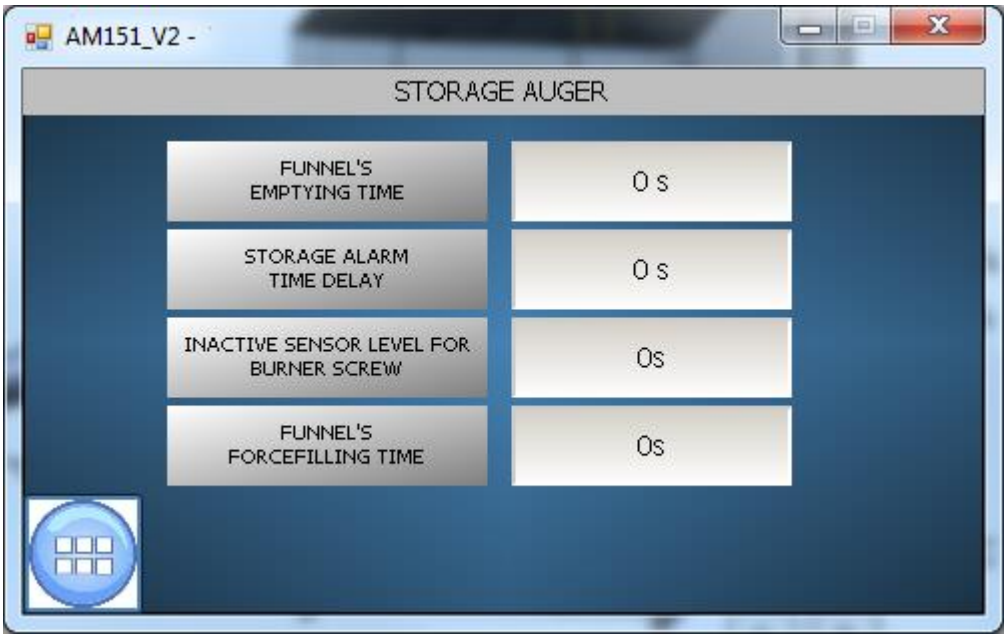


Figure 15. STORAGE AUGER settings

Setting	Factory setting	Setting frequency	Function
Funnel's emptying time	15s	0-60s	When the funnel photocell pair no longer detects fuel in the funnel, the total operating pulse time of the burner screw is calculated. When the set time is reached, the storage auger is activated. The settings define the lower limit of the funnel. When the photocell pair detects fuel, the storage auger stops.
Storage alarm time delay	600s	0-1200s	When the storage auger has run for the set time, but the funnel photocell pair fails to detect the surface of the fuel, the system indicates the **Alarm! Fuel low** alarm.
Inactive sensor level for burner screw	150s	0-600s	If the funnel photocell pair detects fuel during the set time (calculated with the feeder auger pulses), the storage auger is activated for the set duration. The purpose here is to remove any splinters blocking the sensor. NOTE! Settings are displayed if the bar discharger option was selected.
Funnel's force filling time	2s	0-60s	Storage auger running time after the forced filling delay.

Photocell pair located in the funnel measures the fuel level. When the funnel photocell pair no longer detects fuel in the funnel, the total operating pulse time of the burner screw is calculated. When the **Funnel's emptying time** -setting is reached, the storage auger is activated. Time should be set so that there is always fuel on top of the burner screw. For example, too long time setting may result in a lack of fuel in the burner screw, which subsequently hinders combustion.

The storage auger fills the funnel, until the photocell pair detects it, stopping the storage auger. When the storage auger has run for the duration of the **Storage alarm time delay** -setting, but the funnel photocell pair fails to detect the surface of the fuel, the system indicates the **Alarm! Fuel** -alarm.

If the photocell pair detects fuel according to the configuration of the **Tikkuviive** setting (calculated with the burner screw pulses), the storage auger is activated for the duration of the **Inactive sensor level for burner screw** -setting. This may occur, for example, when a splinter is wedged between the sensors. If the splinter is not removed, the system will indicate the **Alarm! Jam** -alarm.

16. Smoke gas fan

Figure 16. SMOKE GAS FAN settings

Setting	Factory setting	Setting frequency	Function
Measured pressure	True value	-100…100Pa	True underpressure in the combustion chamber.
Underpressure at upkeeping	10Pa	0-100Pa	Underpressure setting when burner is in upkeep mode.

Underpressure at effect run	25Pa	0-100Pa	Underpressure setting when burner is in effect mode.
Underpressure alarm limit	-20Pa	-100…0Pa	Combustion chambers overpressure limit reached, followed by "Alarm! Smoke gas fan". NOTE! Limits should be set with a negative marker (-).
Underpressure scaling min.	-100Pa	-100…100Pa	Pressure sensor scaling. NOTE! Requires Maintenance level password.
Underpressure scaling max.	100Pa	-100…100Pa	Pressure sensor scaling. NOTE! Requires Maintenance level password.

The speed of the smoke gas fan is regulated according to the underpressure of the combustion chamber. Underpressure can be set for the **Upkeep** and **Effect** modes.

By pressing the TREND/PID -button, you can review the smoke gas fan adjustments. The underpressure should remain approximately same as the set value. If the smoke gas fan adjustment wavers, its speed can be adjusted with the **Gain (P)** and **Integration time (Ti)** -settings.

17. Accessories

17.1 Bar discharger

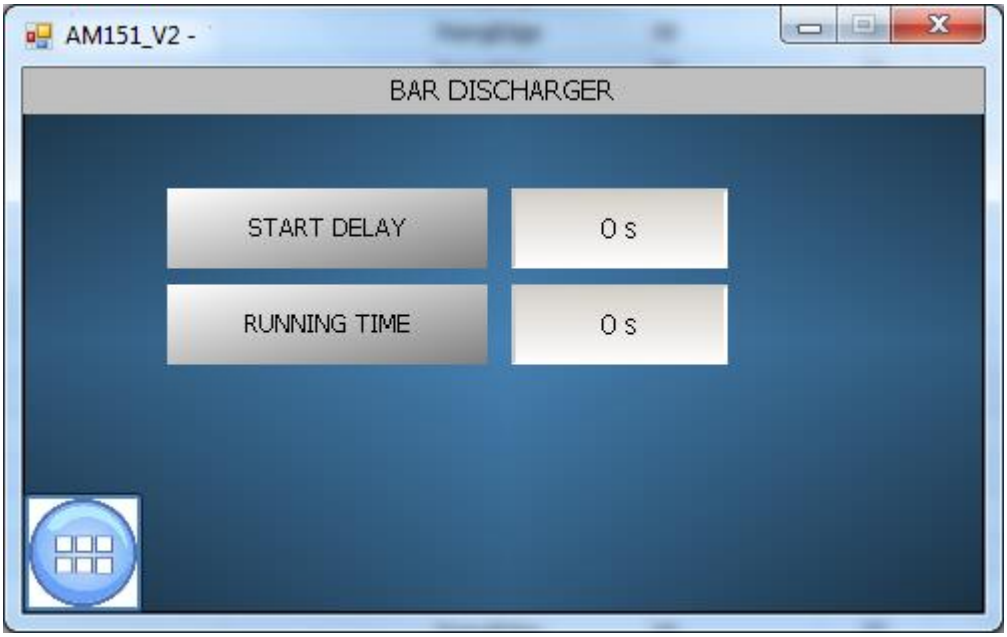


Figure 17. BAR DISCHARGER settings.

Start delay	120s	0-360s	When the storage auger has run

			for the set time, but the funnel sensor has not detected any fuel, the bar discharger is activated for the set duration.
Running time	10s	0-60s	Bar discharger operating time.

If BAR DISCHARGER is selected in the *OPTIONS* -menu, the ***SETTINGS*** -page will also display the *BAR DISCHARGER* -settings. When the storage auger has run for the set **Start delay** -time, but the funnel sensor has not detected any fuel, the bar discharger is activated for the set duration. The bar discharger runs for the duration of the **Running time** -setting. Time should be set so that the cylinder performs one reciprocating motion at most.

17.2 Sweeping settings

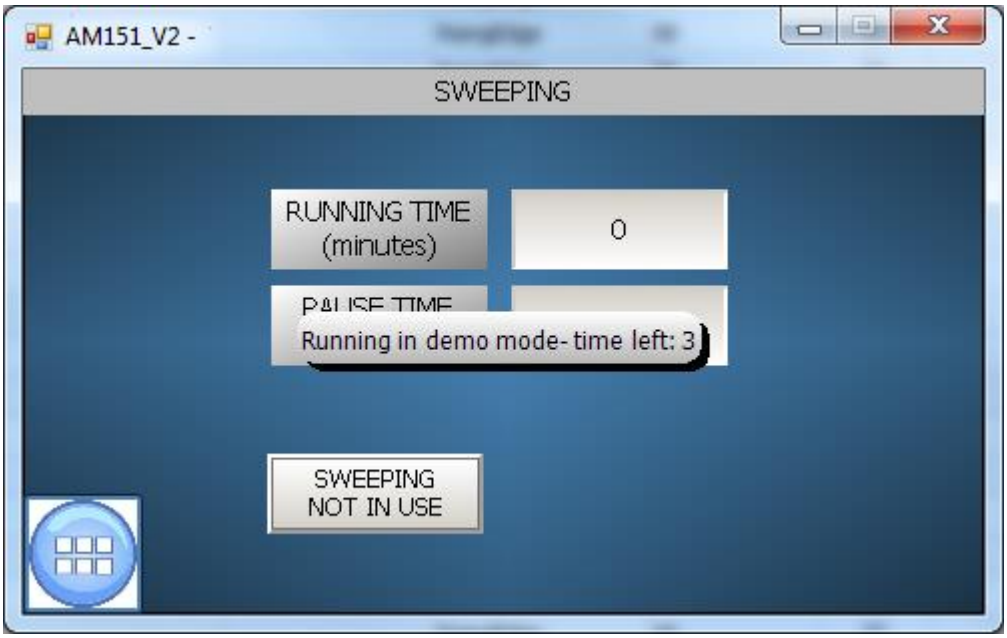


Figure 18. SWEEPING settings

Setting	Factory setting	Setting frequency	Function
Running time (minutes)	4 min	0-60 min	Sweeping duration
Pause time (minutes)	60 min	0-60 min	Sweeping pause duration.

The sweeping motor moves spirals inside the convection pipes in a reciprocating, horizontal motion. The sweeping motor is run for a set time (**Running time** -setting) in set intervals (**Pause time** -setting). NOTE! The boiler should also be swept manually. See boiler instructions.

17.3 Pulse extinguishing

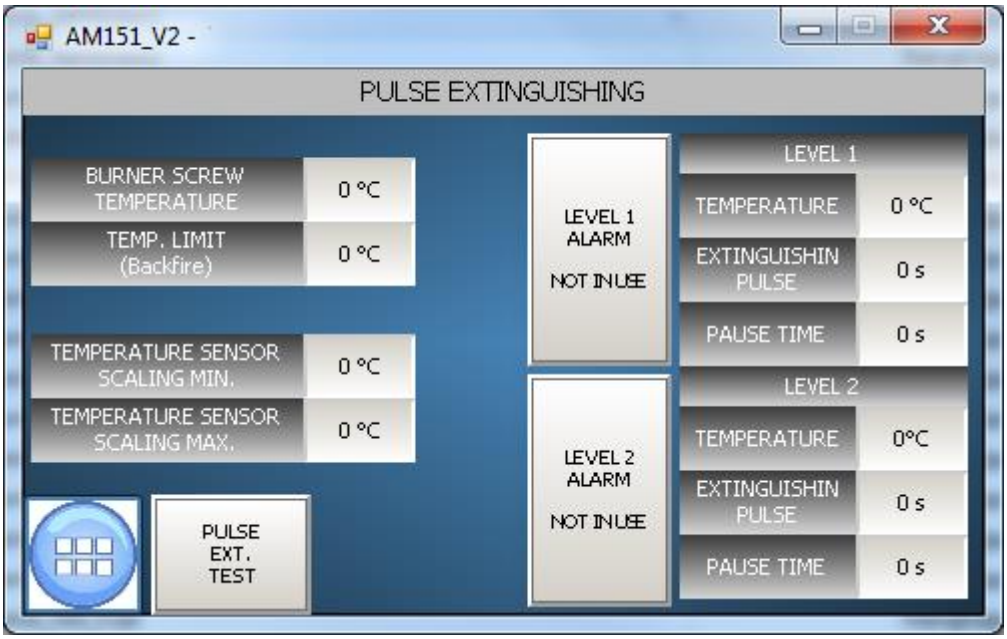


Figure 19. PULSE EXTINGUISHING settings.

Setting	Factory setting	Setting frequency	Function
Burner screw temperature	True value	0-150°C	Burner screw surface temperature
Temp. limit (back fire)	80°C	0-150°C	If the burner screw surface temperature exceeds the set temperature, the system reacts similarly to when a back fire thermostat is set off.
Temperature sensor scaling min.	0°C	0-150°C	Temperature sensor scaling. NOTE! Requires Maintenance level password.
Temperature sensor scaling min.	150°C	0-150°C	Temperature sensor scaling. NOTE! Requires Maintenance level password.
Level 1 temperature	50°C	0-150°C	Feeding auger temperature at which pulse shutdown level 1 humidification starts.
Level 1 Extinguishing pulse	1s	0-10s	Level1 pulse length.
Level1 Pause time	60s	0-360s	Level1 Pause time
Level 2 Temperature	60°C	0-150°C	Feeding auger temperature at which pulse shutdown level 2 humidification starts.
Level 2 Extinguishing pulse	2s	0-10s	Level 2 pulse length.
Level2 Pause time	30s	0-360s	Level2 Pause time

The system can be equipped with a pulse extinguishing system for preventing back fires by humidifying fuel with water when the auger surface temperature increases. There are two humidification temperatures. Pulse extinguishing utilises a Pt100 sensor, which measures the burner screw temperature, and a magnetic valve, which controls the water supply to the burner screw.

NOTE! Water extinguishing system cannot be used with pellets.

When the burner screw surface temperature exceeds the **Level 1 temperature** -setting, the magnetic valve is controlled according to the **Level 1 Extinguishing pulse** and the **Level1 Pause time** -settings. Pulses are continued until the temperature falls below the setting. If the temperature keeps rising, the system will switch to the faster level 2 pulses. If the burner screw surface temperature exceeds the **Temp. limit (back fire)** -setting, the burner will react similarly to when a back fire thermostat is set off.

SMS alarms can be activated with the LEVEL 1/2 ALARM NOT IN USE -buttons.

17.4 Residual oxygen-control

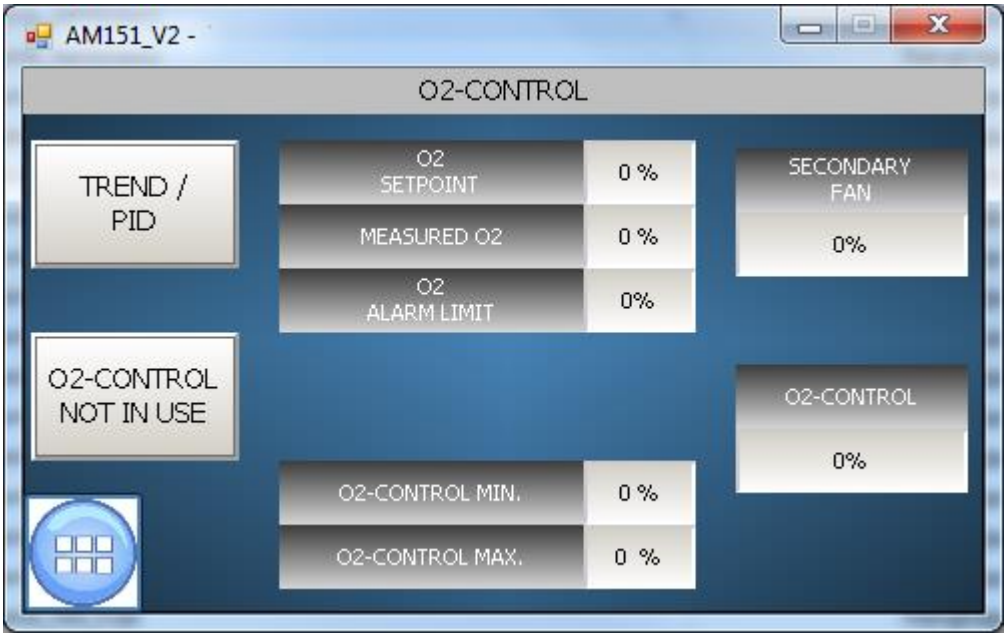


Figure 20. O2-CONTROL settings.

Setting	Factory setting	Setting frequency	Function
O2 set point	8.0%	6.0-15.0%	Residual oxygen target value
Measured O2	True value	0-25%	Residual oxygen true value
O2 alarm limit	4.0%	0-8.0%	Residual oxygen alarm limit.
O2-control minimum	-5.0%	0..-50%	Secondary fan maximum power reduction.
O2-control maximum	15.0%	0-50%	Secondary fan maximum power increase.

The residual oxygen content of the flue gas is measured with a lambda sensor (accessory). The O2 CONTROL NOT IN USE -button determines whether the measured value is applied to the secondary fan power or just displayed as a residual oxygen value. The required oxygen limit is configured in the **O2 set point** -setting. The recommended residual oxygen level is approximately 7-8%. The residual oxygen value can also be viewed on the ***MAIN PAGE***. When the residual oxygen measurement is enabled, it controls the operation of the secondary fan. The correction percentage is displayed on the right.

The **O2-control minimum-** and **O2-control maximum** -settings determine how much the oxygen measurement impacts the secondary fan control. The limits are meant to prevent the secondary fan from being halted due to small values and to prevent high fan speeds in case dirt accumulates on the sensor.

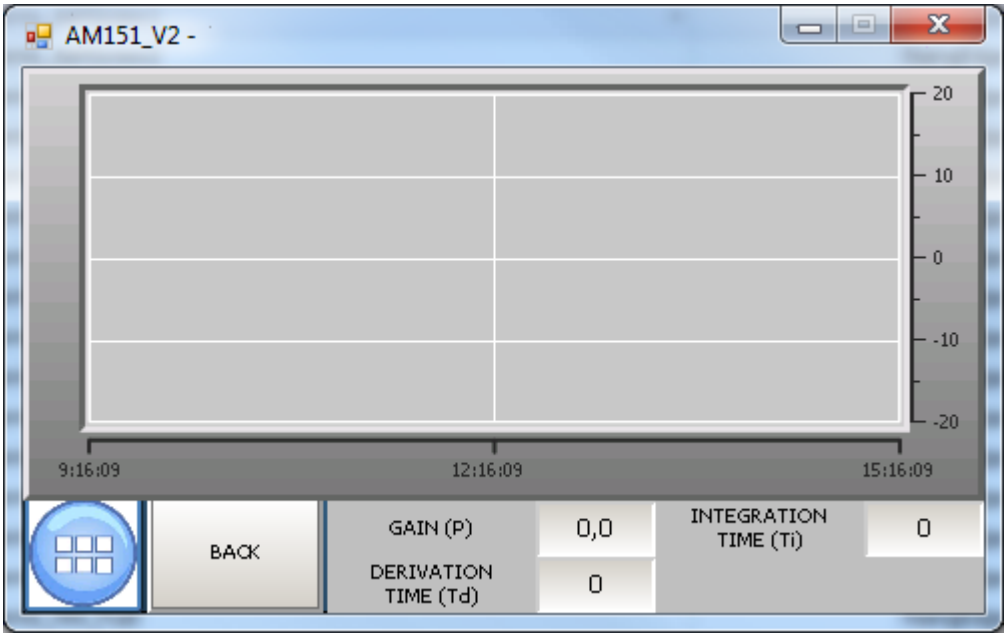


Figure 21. Oxygen regulator trend

By pressing the TRENDI/PID -button, you can monitor the residual oxygen values. This also allows the user to adjust the enhancement and Ti values of the control. The **Gain (P)** and **Integration** (**Ti)** settings (integration) control the adjustment speed and accuracy.

17.5. Ash screws

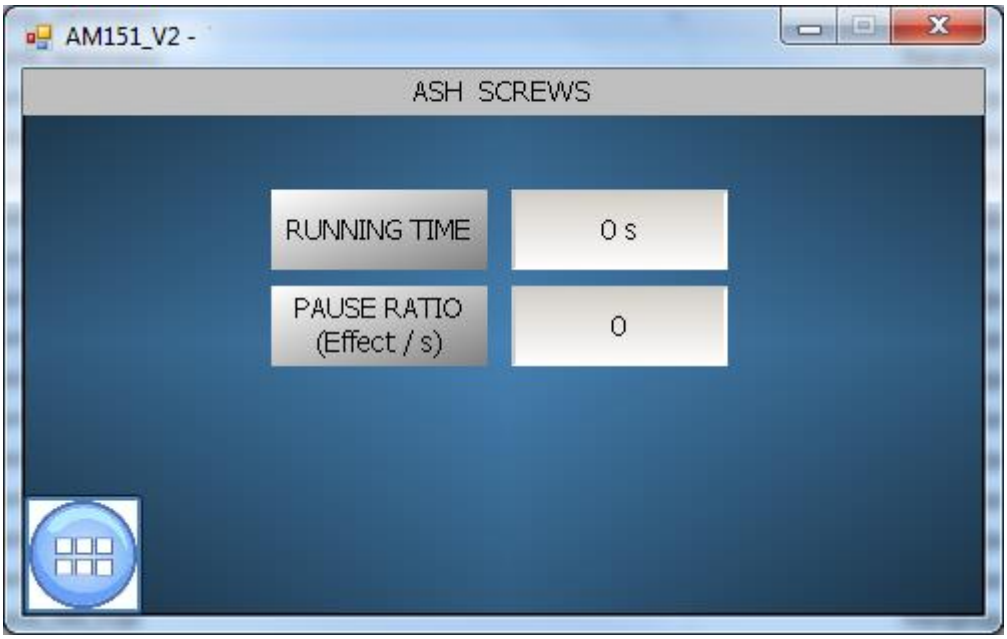


Figure 22. ASH SCREWS settings.

Setting	Factory setting	Setting frequency	Function
Running time	240s	0-600s	Ash removal duration. Ash screw 1 is controlled with pulses while Ash screw 2 auger is controlled continuously.
Pause ratio (Effect/s)	7,200	0-32,000	Ash screw interval relation to the burner effect. For example, if the burner runs for 2h (7,200s) at 100% power, the ash screw are activated.

Ash screws are run according to the burner effect. At higher burner effect levels the pause is shorter than at lower burner effect levels. The **Running time** -setting determines the running duration of the ash screws. The **Pause ratio** determines the ash removal pause length at 100% burner effect level. For example, if the burner runs at 50% effect, the pause is twice as long.

17.6 MultiJet control

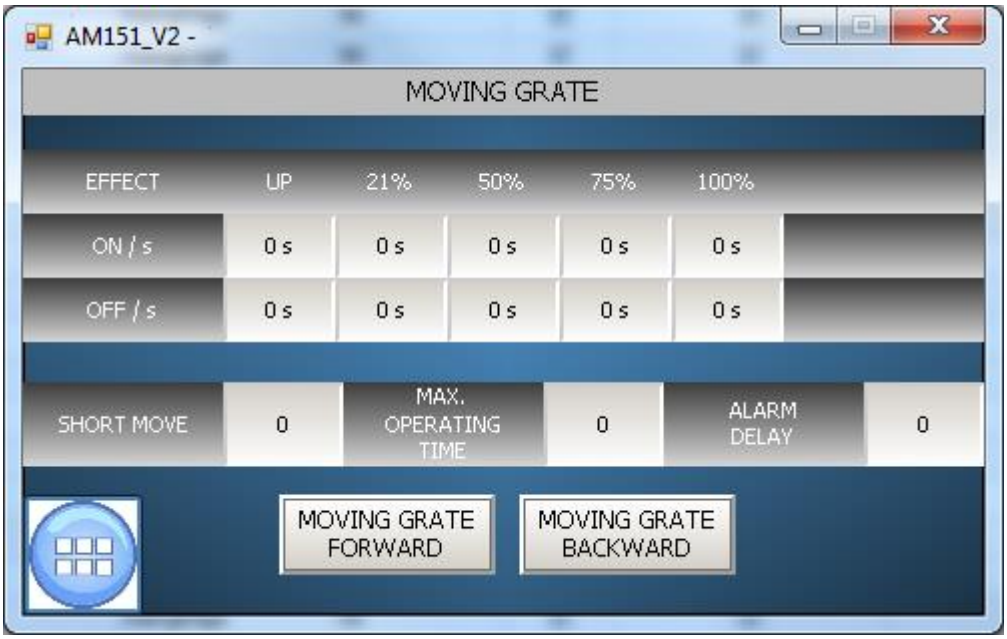


Figure 23. MOVING GRATE settings.

Effect	On/s	Off/s	Function
Upkeep	0.5s	30s	Grate movement pulses in upkeep mode.
21%	0.5s	25s	Grate movement pulses at 21% effect.
50%	1s	20s	Grate movement pulses at 50% effect.
75%	1s	15s	Grate movement pulses at 75% effect.
100%	1s	10s	Grate movement pulses at 100% effect.

Setting	Factory setting	Setting frequency	Function
Short move	100pcs	0-999pcs	The grate movement before performing the cleaning movement (full range). If the setting is 0, the grate will only perform cleaning movements.
Max. operation time	20s	0-360s	Maximum linear motor running time between limit switches.
Alarm delay	30s	0-360s	If the linear actuator limit switches do not detect any furnace movement during the set time, the system will indicate a grate alarm.

The grate of the MultiJet burner is moved with a linear actuator. The linear actuator is moved with pulses which are adjusted according to the burner effect level. The basic movement is approximately 2cm in length, taking place around the outer midline of the linear actuator. The number of basic movements are defined in the **Short move** -setting. After this the grate

performs a cleaning movement, where the linear actuator moves from one end to the other.

The grate pulses (running and pause time) is determined for five power points which the programme uses for calculating times for other power levels.

17.7 Shunt control (Heating circuit control)

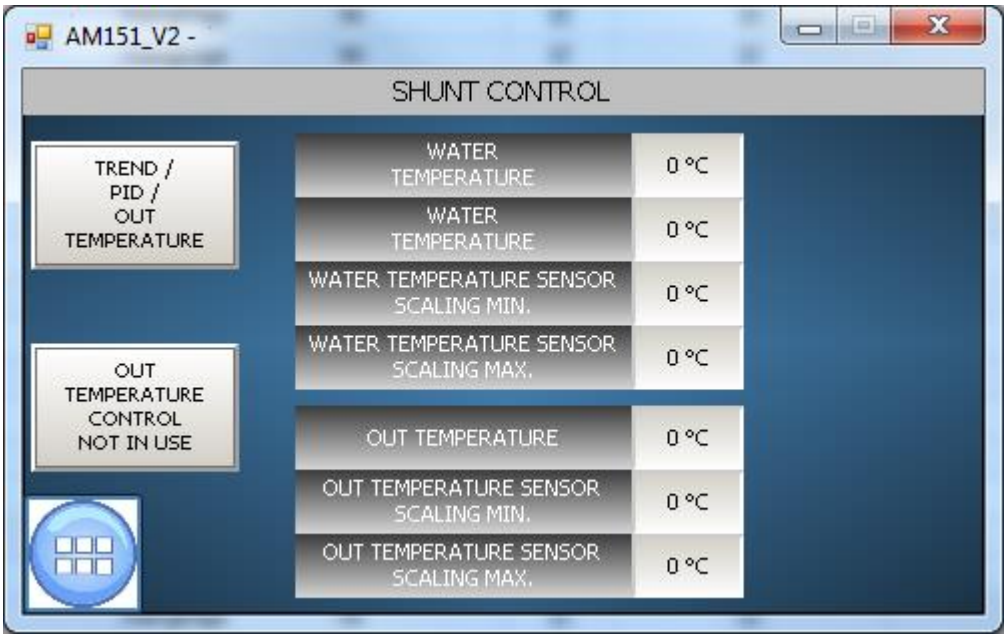


Figure 24. SHUNT CONTROL -settings.

Setting	Factory setting	Setting frequency	Function
Water temperature	True value	-	Supply water temperature
Water temperature	35°C	0-100°C	Supply water temperature setting when shunt control is in the NOT IN USE mode.
Water temperature sensor scaling min.	-10°C	-150…150°C	Supply water temperature sensor scaling NOTE! Requires Maintenance level password.
Water temperature sensor scaling max.	150°C	-150…150°C	Supply water temperature sensor scaling NOTE! Requires Maintenance level password.
Out temperature	True value	-	Outdoor temperature.
Out temperature sensor scaling min.	-50°C	-150…150°C	Outdoor temperature sensor scaling. NOTE! Requires Maintenance level password.
Outdoor temperature sensor scaling max.	50°C	-150…150°C	Outdoor temperature sensor scaling. NOTE! Requires Maintenance level password.

The temperature control features an outdoor temperature sensor, supply water temperature sensor and a 0-10V shunt valve control. The supply water temperature can be fixed (OUT TEMPERATURE CONTROL NOT IN USE - button) or set according to outdoor temperature. The heating curve can be defined with four points, which the system uses to calculate the supply water temperature according to outdoor temperature.

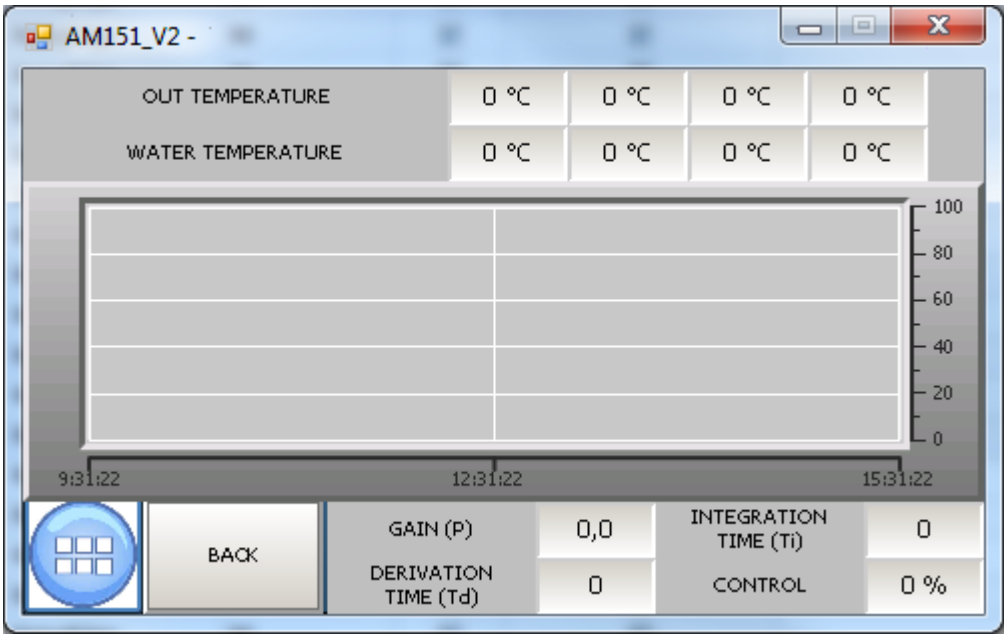


Figure 25. Trend page

Out temperature	-20°C	-5°C	5°C	20°C
Water temperature	35°C	30°C	25°C	20°C

This also allows the user to adjust the enhancement and Ti values of the control. The **Gain (P)** and **Integration time** (**Ti)** -settings (integration) control the adjustment speed and accuracy.

17.8 Smoke gas temperature

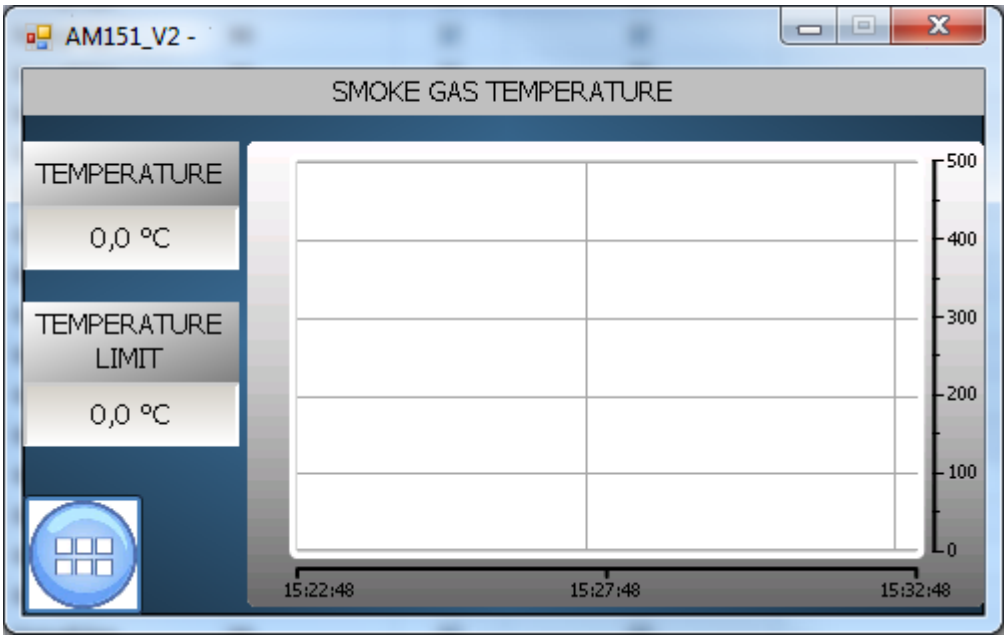


Figure 26. SMOKE GAS TEMPERATURE settings.

The maximum smoke gas temperature, at which the system will indicate an alarm and stop the system, is configured in the **Temperature limit** -setting. The page also indicates smoke gas temperature and trend.

Smoke gas temperature is also displayed on the ***MAINPAGE***.

17.9 Buffer tank control

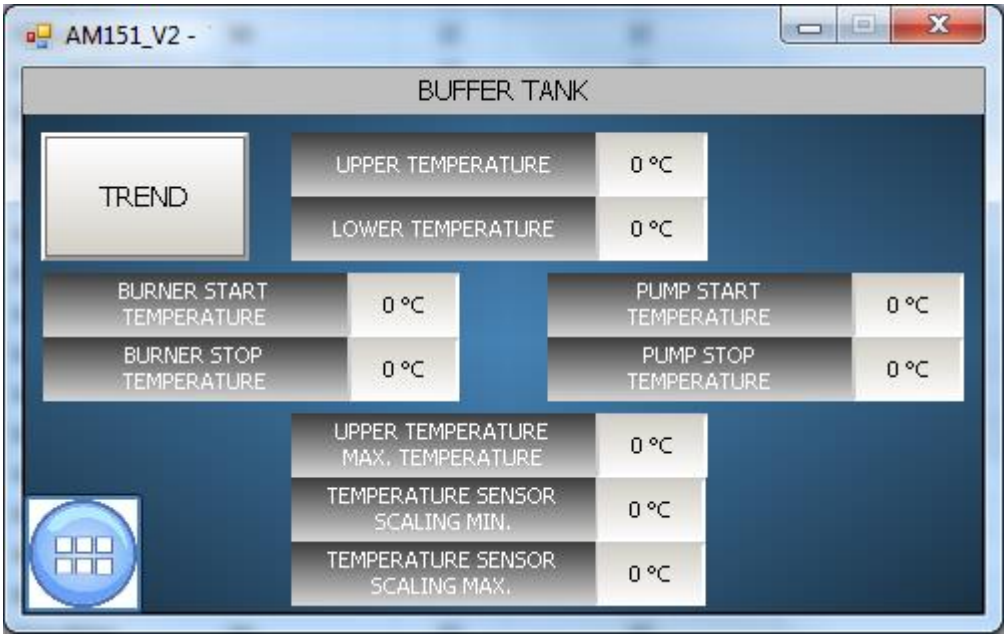


Figure 27. BUFFER TANK settings.

Setting	Factory setting	Setting frequency	Function
Upper temperature	True value	0-100°C	Buffer tank upper temperature.
Lower temperature	True value	0-100°C	Buffer tank lower temperature.
Pump start temperature	80°C	0-100°C	Boiler water temperature at which the load pump starts.
Pump stop temperature	78°C	0-50°C	Boiler water temperature at which the load pump stops.
Burner start temperature	60°C	0-100°C	The burner is activated when the Buffer tank upper temperature falls below the temperature setting.
Burner stop temperature	80 C	0-100°C	When the accumulator lower temperature exceeds the setting, the burner will shut down.
Upper temperature max. temperature	90°C	0-110°C	Buffer tank maximum upper temperature.
Temperature sensor scaling min.	-10°C	-150...150°C	Buffer tank sensor scaling. NOTE! Requires Maintenance level password.
Temperature sensor scaling max	150°C	-150...150°C	Buffer tank sensor scaling. NOTE! Requires Maintenance level password.

Buffer tank control features the Buffer tank upper and lower temperature sensors and load pump control. The burner must be equipped with automatic ignition. Buffer tank usage can be activated from the *OPTIONS* -menu. The burner will begin ignition once the system is set to **Automatic** -mode. When using the system for the first time you should perform a manual ignition, so that the *AUTOMATIC IGNITION* -settings can be done accurately.

You can enable the BUFFER TANK CONTROL -button during the ignition. After the ignition phase, the burner switches to effect mode. When the temperature of the boiler water exceeds the **Pump start temperature** -setting, the load pump starts loading the buffer tank.

When the buffer tank lower temperature exceeds the **Burner stop temperature** -setting, the burner begins shutting down. The storage auger stops and the burner screw is emptied, until the flame detection no longer detects a flame. When no flame is detected, the burner is in standby mode. The load pump stops when the boiler water temperature falls below the **Pump stop temperature** -setting. When the buffer tank upper temperature falls below the **Burner start temperature** -setting, automatic ignition and new loading start.

The **Burner stop temperature** setting should be set so that the fuel in the burner screw does not overheat the accumulator. The boiler water temperature setting should be set higher than the burner stopping temperature in order to increase the burner effect.

The boiler return water should be set at 70°C with an automatic control valve (E.g. Laddomat, ESBE Series VTC500) or a heating circuit control device.

17.10 GSM alarms

The user can define two telephone numbers where SMS alarms/warnings are sent. The SMS PROVIDER -button allows you to enter the operator messaging centre number. You should enter this number in case SMS alarms are not sent.

18. Troubleshooting

Alarm messages indicate the cause of each alarm. See the following chart for possible sources of problems and solutions. The source of the problem should be located and corrected before restarting the system.

Alarm	Cause of problem	Inspect
Alarm! Boiler water over temperature	1. Boiler overheat protection has been set off. 2. The BioJet burner overheat protection has been set off.	Inspect the overheat protection status and acknowledge if necessary. Determine the cause of overheating (e.g. circulation or cooling pump) before restarting the system.

Alarm! Backfire	1. The back fire thermostat has been set off.	Inspect the operation of the back fire thermostat and the temperature setting. Back fire can be caused by, for example, incorrect power settings (in upkeep mode) or overpressure in the combustion chamber.
Alarm! Dry boiling	1. The dry boiling protection has been set off.	Inspect the protection status and acknowledge if necessary. Determine the cause of the alarm (e.g. low network pressure) before restarting the system.
Alarm! Flame	1. The flame detection thermostat does not detect a flame when the burner is in effect mode.	Inspect the flame detection thermostat setting (approximately 70°C) and operation. If the limit is set too high, it may prevent the sensor from detecting the flame. Inspect the cleanliness and operation of the flame detection sensor. Inspect the upkeep effect settings. If power is too low, the ember may go out.
Alarm! Automatic ignition	1. The flame detection sensor has not detected a flame during ignition.	Inspect the automatic ignition settings. Test the operation of the ignition and the flame detection sensor/thermostat.
Alarm! Fuel low	1. The storage auger has run for the duration of the **Storage alarm time delay** -setting, but the funnel photocell pair has not detected any fuel.	Inspect fuel level in the storage or if it has been vaulted. Inspect the storage settings.
Alarm! Burners cooling pump	1. The pump fuse has tripped.	Inspect the fuse and the operation of the pump.
Alarm! Primary fan 1	1. The 4F1 fuse of the fans has tripped. 2. The afn is jammed.	Inspect the fuse and test the fan operation on the Manual -page.
Alarm! Secondary fan 1	1. The 4F1 fuse of the fans has tripped. 2. The fan is jammed.	Inspect the fuse and test the fan operation on the Manual -page.
Alarm! Fire chambers over pressure	1. The combustion chambers overpressure switch has tripped.	Inspect the operation of smoke gas fan and overpressure switch.
Alarm! Burner screw	1. The burner screw thermal relay has tripped. 2. Burner screw contactor	1. Inspect the heat relay current limit. Test the burner screw operation (noises, clutter).
Alarm! Storage auger	1. The storage auger thermal relay has tripped. 2. Storage auger contactor	1. Inspect the thermal relay current limit. Test the storage auger operation (noises, clutter).
Alarm! Bar	1. The bar discharger motor	Inspect the motor protection

discharger	protection has tripped 2. Bar disharger contactor	current limit. Test the hydraulics.
Alarm! Ash screw 1	1. The ash screw motor protection has tripped 2. Ash screw 1 contactor	Inspect the motor protection current limit. Test the hydraulics.
Alarm! Ash screw 2	1. The ash screw motor protection has tripped 2. Ash screw 2 contactor	Inspect the motor protection current limit. Test the hydraulics.
Alarm! Moving grate	1. Linear actuator power exceeds allowable limits 2. The linear actuator has failed to reach the limit within a certain timeframe.	Inspect the operation of the furnace in the Manual -page (grate jammed).
Alarm! Low oxygen	1. Residual oxygen is below the set limit.	Inspect fan operation and adjust the burner by using a flue gas analyser.
Alarm! Smoke gas temperature	1. The smoke gas temperature has exceeded the alarm limit.	Clean the boiler and inspect the convection hatch sealing.
Alarm! Smoke gas fan	1. Overpressure in the combustion chamber (underpressure transmitter)	Inspect the operation of the smoke gas fan and the underpressure transmitter.
Alarm! Safety circuit	1. A security circuit device has tripped (overheat protection, emergency stop, dry boiling, etc.)	Inspect the safety devices and determine the cause of the alarm before restarting the system.
Alarm! Jam	1. The funnel fotocell pair has detected the fuel for **Inactive sensor level for burner screw** -setting time	Inspect the funnel and remove the jammed fuel.
Alarm! Pulse extinguishing	1. There is no pressure in the extinguishing system.	Inspect the pressure.
Alarm! Power shortage > 15 minutes	1. Power shortage has lasted for over 15 minutes.	The system must be restarted.
SMS error	1. No messaging centre number (SMS provider) 2. Bad connectivity	1. Set a messaging centre number in the **SMS** -settings 2. Inspect the connection and place the antenna outside, if necessary.
Pulse shutdown level 1 activated	1. The burner screw surface temperature exceeds level 1.	Inspect the underpressure of comb.chamber and effect settings.
Pulse shutdown level 2 activated	1. The burner screw surface temperature exceeds level 2.	Inspect the underpressure of comb.chamber and effect settings.
External silo level	1. The silo pellet level is below the set limit.	Add more fuel to the storage.